paragraphs and headings as follows:

Applicants claim, under 35 U.S.C. §§ 120 and 365, the benefit of priority of the filing date of November 30, 2002 of a Patent Cooperation Treaty patent application, copy attached, Serial Number PCT/EP02/13547, filed on the aforementioned date, the entire contents of which are incorporated herein by reference, wherein Patent Cooperation Treaty patent application Serial Number PCT/EP02/13547 was not published under PCT Article 21(2) in English.

Applicants claim, under 35 U.S.C. § 119, the benefit of priority of 1) the filing date of January 17, 2002 of a German patent application, copy attached, Serial Number 102 01 496.5, filed on the aforementioned date, and 2) the filing date of September 23, 2002 of a German patent application, copy attached, Serial Number 102 44 235.5, filed on the aforementioned date, the entire contents of each of which are incorporated herein by reference.

Background of the Invention

Field of the Invention

Replace paragraph 0001 with the following paragraph and heading:

The present invention relates to a position measuring device for determining the absolute position ~~in accordance with claim 1~~, as well as a method for absolute position measuring ~~in accordance with claim 9~~.

Description of the Related Art

Replace paragraph 0004 with the following paragraph:

It is stated in the publication "Absolute Position Measurement Using Optical Detection of Coded Patterns" by J.T.M. Stevenson and J.R. Jordan in Journal of Physics E / Scientific Instruments 21 (1988), No. 12, pp. 1140 to 1145, that each code element includes ~~consists of~~ a predetermined sequence of two partial areas with optical properties which are complementary

to each other.

Replace paragraph 0007 with the following heading and paragraph:

SUMMARY AND OBJECTS OF THE INVENTION

Thus, an ~~the~~ object of the present invention is based on creating an absolute position measuring device of high dependability or operational reliability, by ~~means of~~ which the generation of the absolute position as error-free as possible is therefore possible.

Replace paragraph 0008 with the following paragraph:

This object is attained by a position measuring device including a code having a first code element and a second code element arranged one behind the other in a measuring direction, wherein each of the first and second code elements includes a first partial area and a second partial area, which are complementary to each other and are arranged sequentially in the measuring direction. A scanning device including a plurality of detector elements that scan the first and second code elements and for forming a first scanning signal within the first partial area of the first code element and a second scanning signal within the second partial area of the first code element. An evaluation unit including a comparison device, which compares the first scanning signal with the second scanning signal and forms binary information for the first code element as a function of the comparison ~~means of the characteristics of claim 1~~.

Replace paragraph 0009 with the following paragraph:

A further object of the present invention is based on disclosing a method for determining an absolute position, by ~~means of~~ which a generation of the binary information, and therefore of the absolute position, as free as possible of errors is made possible.

Replace paragraph 0010 with the following paragraph:

This object is attained by a method for absolute position measuring that includes

scanning a code having a first code element and a second code element arranged one behind the other in a measuring direction, wherein each of the first and second code elements includes a first partial area and a second partial area, which are complementary with respect to each other and are arranged following each other in the measuring direction. Generating a first scanning signal within the first partial area of the first code element and a second scanning signal within the second partial area of the first code element. Comparing the first and second scanning signals with each other and forming binary information from the comparing ~~means of the characteristics of claim 9~~.

Delete paragraph 0011.

Replace paragraph 0012 with the following paragraph:

The present invention will be explained in greater detail by ~~means of~~ the drawings, wherein is shown in:

Replace paragraph 0013 with the following heading and paragraph:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1[,] shows an embodiment of a position measuring device in a schematic representation[,] in accordance with the present invention;

Replace paragraph 0014 with the following paragraph:

FIG. 2[,] shows the principle of an embodiment of an error test[,] in accordance with the present invention;

Replace paragraph 0015 with the following paragraph:

FIG. 3[,] shows possible ~~the~~ signals for error testing in accordance with FIG. 2[,];

Replace paragraph 0016 with the following paragraph:

FIG. 4[,] shows an embodiment of a position measuring device with an incremental track for generating control signals[,] in accordance with the present invention;

Replace paragraph 0017 with the following paragraph:

FIG. 5a[,] shows possible analog scanning signals from the incremental track[,] of FIG. 4;

Replace paragraph 0018 with the following paragraph:

FIG. 5b[,] shows possible control signals from the analog scanning signals in accordance with FIG. 5a[,];

Replace paragraph 0019 with the following paragraph:

FIG. 6a[,] shows a first scanning position of the position measuring device[,] of FIG. 4;

Replace paragraph 0020 with the following paragraph:

FIG. 6b[,] shows a second scanning position of the position measuring device[,] of FIG. 4;

Replace paragraph 0021 with the following paragraph:

FIG. 6c[,] shows a third scanning position of the position measuring device[,] of FIG. 4; and

Replace paragraph 0022 with the following paragraph:

FIG. 6d[,] shows a fourth scanning position of the position measuring device of FIG. 4.

Replace paragraph 0023 with the following heading and paragraph:

DESCRIPTION OF THE PREFERRED EMBODIMENT(S) OF THE INVENTION

A position measuring device equipped in accordance with the present invention is schematically represented in FIG. 1. This position measuring device operates in accordance with the optical scanning principle, wherein a code C is scanned ~~by means~~ of the transmitted light method. A scanning device AE arranged, movable in the measuring direction X relative to the code C, is used for scanning the code C.

Replace paragraph 0024 with the following paragraph:

The code C ~~consists of~~ includes a sequence of code elements C1, C2, C3 of equal length, arranged one behind the other in the measuring direction X. In turn, each code element C1, C2, C3 includes ~~consists of~~ two partial areas A and B of equal length, sequentially arranged in the measuring direction immediately following each other, which are designed complementary to each other. In this case complementary means that they have inverse properties, i.e. in case of an optical scanning principle are transparent or not transparent, or in case of incident light scanning are reflecting or non-reflecting.

Replace paragraph 0026 with the following paragraph:

The detector element D is a line sensor with a sequence of detector elements D1 to D11, which are arranged in the measuring direction X. In each relative position, at least one detector element D1 to D11 is unequivocally assigned to each partial area A, B of the code elements C1, C2, C3, so that in every relative position of the detector unit D with respect to the code C a scanning signal S1A to S3B is obtained from each partial area A, B. These scanning signals S1A to S3B are conducted to an evaluation device AW, which compares each of the two scanning signals S1A, S1B, S2A, S2B, S3A, S3B of the two partial areas C1A, C1B, C2A, C2B, ~~C2A, C2B,~~ C3A, C3B of a code element C1, C2, C3 with each other and, by its comparison creates a digital value, or a bit B1, B2, B3 for each code element C1, C2, C3. A sequence of several digital values B1, B2, B3 results in a codeword CW, which defines the absolute position. In case of a displacement of the detector unit D with respect to the code C by a width or length of a code element C1, C2, C3, a new code word CW is generated, and a multitude of different code words CW is formed over the measuring area to be absolutely measured.

Replace paragraph 0027 with the following paragraph:

FIG. 1 shows a momentary position of the code C in relation to the scanning device

AE. The detector elements D1 to D11 are arranged in sequence at a distance of one-half the width of a partial area C1A to C3B of the code C. By ~~means of~~ this it is assured that in each position at least one detector element D1 to D11 is unequivocally assigned to a partial area C1A to C3B and does not scan a transition between two partial areas C1A to C3B. In the position represented, the partial area C1A is scanned by the detector element D1, and the partial area C1B by the detector element D3. The detector elements D1, D3 detect the light distribution and generate, as a function of the light intensity, an analogous scanning signal S1A, S1B. Since the two partial areas C1A and C1B are embodied complementary to each other, the intensity of the scanning signals S1A and S1B is also inverse with respect to each other, therefore the signal levels are distanced far apart from each other.

Replace paragraph 0028 with the following paragraph:

This signal distance is now utilized for generating the binary information B1 in that a check is made which of the two scanning signals S1A, S1B of the code element C1 is greater. This check can be made by forming a quotient or by forming a difference. Difference formation is used in the example, wherein in accordance with FIG. 1 a trigger module T1 is used as the comparison device. The trigger module T1 generates B1=0, if S1A is less than S1B, and B1=1, if S1A is greater than S1B. In the same way binary information B2 and B3 is obtained by scanning the code elements C2, C3 and comparing the analog scanning signals S2A, S2B, S3A, S3B, and by comparison of the partial areas C2A, C2B, C3A, C3B of respective code elements C2, C3 by ~~means of~~ trigger modules T2, T3.

Replace paragraph 0034 with the following paragraph:

In connection with the example of the detector elements D1 and D2 it is easy to see in FIG. 1 that, in the course of a displacement of the code C by the length of a partial area A, B toward the left, the detector element D1 scans the partial area C1B, and the detector elements

D3 the partial area C2A, i.e. partial areas of two code elements C1, C2. Thus the trigger module T1 cannot provide binary information B1, B2, B3 assigned to a code element C1, C2, C3. In what follows, steps will be explained by ~~means of~~ which it can be assured that the correct detector elements D1 to D11 are used for creating code words, i.e. those detector elements D1 to D11 which respectively scan the partial areas of a single code element C1, C2, C3.

Replace paragraph 0035 with the following paragraph:

A preferred method for this is described by ~~means of~~ FIGS. 4 to 6. In accordance with FIG. 4, an incremental track R with a periodic graduation of the period length corresponding to the length of a code element C1, C2, C3 is arranged parallel next to the code C. In a known manner, the incremental track R is scanned by at least two detector elements DR1, DR2, which are offset with respect to each other in the measuring direction X by ¼ graduation period, for generating two analog scanning signals SR1, SR2, which are phase-shifted with respect to each other by 90°. These analog scanning signals SR1, SR2 are interpolated in a known manner, and the interpolated position value is combined with the code word CW, so that the rough absolute position measurement is refined by the high-resolution incremental measurement.

Replace paragraph 0036 with the following paragraph:

The length of each code element C1, C2, C3 is interpolated by the incremental measurement. A differentiation between the right and the left partial area of a code element C1, C2, C3 is now possible in a simple manner by ~~means of~~ the interpolation value. A quadruple interpolation, i.e. a one-time triggering of the analog scanning signals SR1, SR2 is sufficient for differentiating the partial areas A and B. The bit combination from the digital signals E1, E2 obtained from this defines the sequence of the partial areas A, B unequivocally, and it is used as the control signal for determining the detector element D1 to D11 from which

a correct code word CW can be created. Thus, the digital signals E1, E2 define which scanning signals S must be compared with each other, and from which scanning signals S it is possible to obtain digital values B1, B2, B3 for the code word CW.

Replace paragraph 0040 with the following paragraph:

A further possibility for determining the correct detector elements D1 to D11, or the correct analog scanning signals S, includes ~~consists in~~ that all detector elements D1 to D11, which are spaced apart from each other at the distance of the length of a partial area A, B, are compared with each other. At the distance of a code element C1, C2, C3 there are the detector pairs D1, D3 and D5, D7 - in accordance with the example of the momentary position P4 represented in FIG. 6d - each of which scans in a desired manner the difference of the partial areas A, B of a code element C1, C2. The further detector pairs D3, D5 scan successive partial areas A, B of two successive code elements C1, C2, and in this way create an error signal F1 by ~~means of~~ the error check device P explained by ~~means of~~ FIG. 2. Now, for determining the correct detector elements D1 to D11, a search is made for the detector group D1, D3, D5, D7 in which error signals F occur the least. In detail, for performing this second possible method the following arrangement, or the following method steps, is/are required:

- detector elements D1 to D11 are arranged in the measuring direction X at distances corresponding to half the length of a partial area A, B,

- the detector elements D1 to D11 form a first group (the even-numbered detector elements D2, D4, D6, D8, D10 in FIGS. 6a to 6d) at a mutual distance corresponding to the length of a partial area A, B,

- the detector elements D1 to D11 form a second group (the odd-numbered detector elements D1, D3, D5, D7, D9) at a mutual distance corresponding to the length of a partial area A, B,

- the detector elements D2, D4, D6, D8, D10 of the first group are arranged offset by half the length of a partial area A, B with respect to the detector elements D1, D3, D5, D7, D9 of the second group,

- detector elements of a group immediately following each other are respectively differentially connected,

- the results of the comparison of those pairs of detector elements of the two groups are now used in a pattern corresponding to the length of a code element C1, C2, C3 for forming the code word CW, whose sequence generates the least errors F, thus, in accordance with FIG. 6d, the sequence (D1-D3)=B1, (D5-D7)= B2, etc.

Replace paragraph 0041 with the following paragraph:

The two partial areas A, B of each code word C1, C2, C3 can be embodied to be optically scannable, wherein then one partial area A is embodied transparent or reflecting the scanning light, and the other partial area B opaque or non-reflecting. However, the present invention is not limited to the optical scanning principle.

After paragraph 0043 insert the following paragraph:

Further embodiment variations of the method in accordance with the present invention of course exist besides the explained example.

Replace the paragraph beginning at page 10, line 1, with the following paragraph:

~~Claims~~ We Claim:

After page 13 add a new page 14 to read as follows:

Abstract of the Disclosure

A position measuring device including a code having a first code element and a second code element arranged one behind the other in a measuring direction, wherein each of the first and second code elements includes a first partial area and a second partial area, which are

complementary to each other and are arranged sequentially in the measuring direction. A scanning device including a plurality of detector elements that scan the first and second code elements and for forming a first scanning signal within the first partial area of the first code element and a second scanning signal within the second partial area of the first code element. An evaluation unit including a comparison device, which compares the first scanning signal with the second scanning signal and forms binary information for the first code element as a function of the comparison.